Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees	)	WT Docket No. 10-153
Request for Interpretation of Section 101.141(a)(3) of the Commission's Rules Filed by Alcatel-Lucent, Inc., *et al.*	)	WT Docket No. 09-106
Petition for Declaratory Ruling Filed by Wireless Strategies, Inc.	)	WT Docket No. 07-121
Request for Temporary Waiver of Section 101.141(a)(3) of the Commission's Rules Filed by Fixed Wireless Communications Coalition	)	

COMMENTS OF COMSEARCH

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SUMMARY

The current Part 101 point-to-point microwave rules successfully support a growing and robust telecommunications industry. The key attribute of these rules is that access to the spectrum for point-to-point microwave links service is made available on a first-come first-served basis, with all licensees having an equal opportunity to the bands, which are generally available when and where they are needed. Sharing spectrum for point-to-point service through frequency coordination maximizes re-use of channels by multiple licensees and minimizes instances of mutual exclusivity, resulting in efficient spectrum usage.

Comsearch supports the Commission's decision to deny the request of Wireless Strategies, Inc. ("WSI") for a declaratory ruling. Not only was the WSI proposal inconsistent with the Commission's rules, but it rested on the flawed premise that once a microwave link is successfully coordinated and licensed, additional auxiliary links can be designed to re-use the same frequency near the coordinated/licensed transmitter without causing harmful interference to other microwave links. In fact, the WSI approach would result in maximizing the operating area of the auxiliary stations at the expense of other licensees.

Comsearch is concerned with the FCC's request for comment on whether to modify the rules to incorporate suggested improvements on the WSI proposal for auxiliary stations, such as requiring frequency coordination and licensing. As discussed in detail below, even the FCC's proposal for auxiliary links would undercut the basic spectral efficiency principles of the Part 101 Rules by permitting (1) the use of minimally compliant antennas as well as non-compliant antennas; (2) unreasonably high Equivalent Isotropically Radiated Power; (3) the inappropriate mixing of Time Division Duplex systems in bands with exclusively Frequency Division Duplex characteristics; and (4) stations exempt from bandwidth efficiency requirements.

The FCC proposal to allow licensees to operate links below the Section 101.141(a)(3) required payload capacity during periods of anomalous signal fading (so-called "adaptive modulation"), in order to keep a well-designed link operating through periods it would otherwise be unavailable, is a worthy objective. However, in crafting any rule change the Commission must take into account the possibility that adaptive modulation may be used to implement links that are designed to a lower standard than is presently used. In order to avoid that risk, Comsearch recommends that additional requirements for path design with adaptive modulation should be added to Section 101.141(a)(3) of the rules.

Comsearch agrees that it should be possible to coordinate shared usage of fixed systems in the 7 GHz and 13 GHz bands among BAS, CARS, and Part 101 users under the Section 101.103(d) notification-and-response procedures. However, the exemption of mobile (temporary fixed) BAS and CARS stations from these procedures will make it difficult for Part 101 users to share the bands. An approach that may have some merit is segmenting the bands into a group of channels available only for fixed usage and shared with Part 101, and another group available for fixed and mobile usage.

The questions raised in the *Notice of Inquiry* ("*NOI*") portion of the proceeding would benefit from further study. Relaxing the current payload capacity standards in "rural areas"

would undoubtedly result in cost savings; but, as usage grows, adding inefficient links could hasten the transformation of a clear area into a congested area. Moreover, determining where efficiency standards could be reduced safely may prove problematic. Due to technical, economic, and regulatory factors that encourage licensees to co-locate, there are a large number of sites that are highly congested in terms of microwave usage that are nevertheless "rural" in terms of population density.

Using smaller antennas as suggested in the *NOI* can result in an increase in interference potential as a result of the wider beamwidth, reduced sidelobe suppression, and possibly worse front-to-back ratio that smaller antennas entail. Certain adjustments can be made, however, to achieve a reasonable tradeoff between spectral efficiency and meeting the goals of lower cost, ease of installation, and less obtrusive appearance. Comsearch provides several specific recommendations in the text.

Comsearch offers a number of other proposals to encourage more flexible and efficient use of spectrum:

- The FCC should conform its rules to the requirements of the International Telecommunications Union Radio Regulations in order to reduce the circumstances under which applicants for point-to-point microwave must file waivers for antennas aimed near the geostationary arc.

- With respect to "minimum payload capacity," both Section 101.141(a)(3) of the FCC's rules and the FCC Form 601 application form would benefit from additional clarification.

- To simplify the process of licensing systems with adaptive modulation, Comsearch recommends that the Commission allow the applicant to enter the frequency once on FCC Form 601 and to indicate use of adaptive modulation with a Yes/No checkbox.

- The Commission should delete Section 101.147(s)(8) for 23 GHz "low power limited coverage systems" as outmoded and unnecessary.

Finally, the Commission should act promptly and favorably on two pending petitions for rulemaking filed by the Fixed Wireless Communications Coalition ("FWCC"): (1) RM-11605, in which the FWCC requests the Commission to amend its rules to allow non-Federal fixed microwave systems to share the Federal 7,125 – 8,500 MHz band; and (2) RM-11610, in which the FWCC seeks to improve Federal/Non-Federal coordination in the 23 GHz band and to allow conditional authorization based on prior coordination across the entire band.

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To: The Commission

COMMENTS OF COMSEARCH

Comsearch hereby submits comments on the *Notice of Proposed Rulemaking and Notice of Inquiry* ("*NPRM/NOI*") issued by the Commission on August 5, 2010, in the above-captioned proceeding.[1] In the *NPRM/NOI,* the Commission proposes to promote the efficient use of microwave spectrum for wireless backhaul, to update its Part 101 technical rules, and to provide

[1] Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees, *Notice of Proposed Rulemaking and Notice of Inquiry*, FCC 10-146 (rel. Aug. 5, 2010) ("*NPRM/NOI*").

users increased flexibility. Comsearch commends the FCC for undertaking this examination of its technical rules and regulatory classifications in order to help promote access to wireless backhaul solutions needed for the next generation of mobile broadband networks and other important applications.

Comsearch is a leading provider of spectrum management and wireless engineering products and services to the commercial and federal market. Since 1977, Comsearch has been actively engaged with Commission, the National Telecommunications Information Administration ("NTIA"), and various industry groups and standards organizations to develop rules, industry recommendations, and standards that promote the efficient use of the radio spectrum. Comsearch's extensive experience providing frequency coordination services for fixed point-to-point systems, point-to-multipoint, and satellite service earth stations is particularly relevant to this proceeding.

Below, Comsearch responds to many of the proposals raised in the *NPRM/NOI* including:

- Opposing the proposal to allow "auxiliary" fixed stations because their use will negatively impact the efficient use of microwave spectrum;
- If the Commission allows adaptive modulation, urging it to take care not to adopt rules that would encourage the deployment of lower performance antennas;
- Supporting the FCC's efforts to promote greater sharing between the FS, BAS, and CARS, but advising the Commission of certain technical issues related to sharing;
- Providing cautionary feedback on questions raised in the NOI with respect to efficiency standards in rural areas and the use of smaller antennas; and
- Supporting prompt and favorable action on the pending Petitions for Rulemaking (RM-11605 and RM-11610) filed by the Fixed Wireless Communications Coalition.

Finally, Comsearch offers a number of proposals for the FCC to take in order to encourage more flexible and efficient use of spectrum in a number of areas including: geostationary orbital intersection; payload capacity requirements; streamlining the application requirements for adaptive modulation; and low power limited coverage systems.

I. THE COMMISSION SHOULD REJECT THE PROPOSAL TO PERMIT OPERATION OF "AUXILIARY" FIXED STATIONS

A. The Part 101 Rules Already Encourage Spectral Efficiency

The Part 101 point-to-point microwave rules successfully support a growing and robust telecommunications industry. In this regard, the current rules are carefully designed to give *all* users fair and equal access to fixed service ("FS") backhaul spectrum. As a result, thousands of licensees utilize the bands, representing virtually every market segment including carriers, critical infrastructure, public safety, internet service providers, large and small enterprise, broadcast, cable, and state and local governments.

The key attribute of the Part 101 rules is that access to the spectrum for point-to-point microwave links service is made available on a first-come first-served basis, with everyone having an equal opportunity to the bands, which are generally available when and where they are needed. Also, an FS license is relatively inexpensive, and licenses are free for State and Local Governments and non- profit entities. Table A shows the continued growth in the number of licensed and applied-for channels in the primary point-to-point bands between 6 and 23 GHz. Under the existing Part 101 rules, applications for microwave facilities continue to increase in each band with growth rates in the double and triple digits over the five-year period between 2004 to 2009.

Band (MHz)		2004	2009	Growth
Lower 6	5925 - 6425	34,345	39,297	14%
Upper 6	6525 – 6875	30,105	33,390	11%
10 GHz	10550 - 10680	4,549	5,918	30%
11 GHz	10700 - 11700	10,002	28,565	186%
18 GHz	17700 - 19700	8,878	26,687	201%
23 GHz	21200 - 23600	8,819	22,356	173%

Table A: Nationwide Channel Count by Band: Licensed and Applied Status (Comsearch Data)

Sharing spectrum for point-to-point service through frequency coordination maximizes re-use for multiple licensees and minimizes instances of mutual exclusivity. Comsearch strongly believes that the ready access to microwave channels and the re-use of the channels by multiple licensees under the Part 101 point-to-point rules is a success story of efficient spectrum usage.

B. The Proposal for Auxiliary Fixed Stations Will Reduce Spectrum Efficiency by Crowding Out Other Licensees

Under the Commission's current rules, a fixed station is defined as a "station operating at a fixed location,"[2] and a license is required for each station.[3] The Part 101 rules require evaluation and coordination of proposed point-to-point microwave stations on a site-by-site, path-by-path basis and do not provide for the aggregation of multiple sites and paths. As noted in the *NPRM/NOI*, Wireless Strategies, Inc. ("WSI") filed a petition in February 2007 seeking a declaratory ruling "confirming that a Fixed Service licensee is permitted to simultaneously coordinate multiple links whose transmitter elements collectively comply with the Commission's antenna standards and frequency coordination procedures."[4] WSI's proposal rested on the flawed premise that once a microwave link is successfully coordinated and licensed, additional auxiliary links could be designed to re-use the same frequency near the coordinated/licensed transmitter without causing harmful interference to other microwave links.[5] Comsearch strongly opposed the WSI proposal because the WSI approach would result in maximizing the operating area of the auxiliary stations at the expense of other licensees. The WSI proposal would

[2] 47 C.F.R. § 1.907.

[3] 47 C.F.R. § 1.903(a).

[4] Request of Wireless Strategies, Inc. for Declaratory Ruling, WT Docket No. 07-121, at 1 (dated Feb. 23, 2007) ("WSI Petition") (citations omitted). *See generally NPRM/NOI* at ¶¶ 43-58.

[5] WSI Petition at 5-7.

essentially create an area-wide license under the guise of the site-by-site, point-to-point licensing and significantly undercut the efficiency of the Part 101 rules outlined above.

Comsearch and a number of other commenters objected to the WSI petition for declaratory ruling as inconsistent with both the language and the intent of the Commission's rules.[6] In the *NPRM/NOI*, the FCC rightly denied the WSI petition for declaratory ruling, correctly noting that under current rules "[e]ach site must be considered a separate station, with the potential to cause interference to other stations, and consequently each site is individually subject to the rules governing fixed microwave stations."[7] Comsearch strongly supports the Commission's decision to deny the WSI petition for declaratory ruling.

Although the FCC found that WSI's proposed interpretation was inconsistent with the plain wording of Part 101, the FCC nevertheless seeks comment on proposed rule changes that would authorize auxiliary links.[8] While the FCC has attempted to make some improvements from the WSI proposal for auxiliary stations, such as requiring frequency coordination and licensing, even the FCC's proposal would undercut the basic spectral efficiency principles of the Part 101 Rules by permitting (1) the use of minimally compliant antennas as well as non-compliant antennas; (2) unreasonably high Equivalent Isotropically Radiated Power ("EIRP"); (3) Time Division Duplex ("TDD") systems in bands with exclusively Frequency Division

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[6] Comments of Comsearch, WT Docket No. 07-121 (filed July 19, 2007). *See also* Comments of the National Spectrum Managers Association, WT Docket No. 07-121 (filed July 19, 2007); Comments of Harris Stratex Networks, Inc., WT Docket No. 07-121 (filed July 19, 2007); Opposition of Alcatel-Lucent to Request for Declaratory Ruling, WT Docket No. 07-121 (filed July 19, 2007); Comments of the Society of Broadcast Engineers, Inc., WT Docket No. 07-121 (filed July 19, 2007); Comments of Mobile Satellite Ventures Subsidiary LLC and TerreStar Networks, Inc., WT Docket No. 07-121 (filed July 19, 2007); Reply Comments of the Fixed Wireless Communications Coalition, WT Docket No. 07-121 (filed Aug. 20, 2007).

[7] *NPRM/NOI* at ¶ 49 (citation omitted).

[8] *Id.* ("WSI's proposal to consider the performance of a system on an aggregate basis is not consistent with the plain wording of our rules for two reasons.").

Duplex ("FDD") characteristics; and (4) stations exempt from bandwidth efficiency requirements.

1. The Use of Auxiliary Stations Will Compromise Frequency Re-use and Antenna Standards

The auxiliary station proposal is based on flawed assumptions that would compromise the efficiency of the Part 101 rules. In discussing the auxiliary station proposal, the *NPRM/NOI* includes a diagram of a keyhole-shaped area as a representation of the "preclusive effect that an FS station [antenna] creates with respect to stations sharing the same spectrum . . . ."[9] The Commission acknowledges that the "characterization is oversimplified" and "does not tell the whole story."[10] Comsearch wholeheartedly agrees with the FCC's clarifying statements.

Frequency Re-use. The WSI proposal fundamentally rests on the incorrect notion that coordinating a link creates a specific defined area (e.g., keyhole-shaped) where other links cannot be located. However, the keyhole shape is a representation of the *coordination area* around a link – the area in which other links should be studied for interference – but is not an exclusion zone where other links may not be located. The Commission correctly recognizes that the standard for locating another link nearby is whether the calculations show there would be unacceptable interference, not whether the new link is outside any particular area around the existing link.[11] Contrary to the claims of the proponents of the WSI concept, there is no natural dark space "service area" for auxiliary stations to operate near a licensed link, and re-use of frequencies multiple times by other licensees within an area is very common. It is even possible to re-use the same frequencies at the same station – for example, Comsearch data shows that

[9] *Id*. at ¶ 51.

[10] *Id.*

[11] *Id.*

there are approximately 1,500 licensed stations in the 6 GHz band that use the same frequency pair in more than one direction.

Figure 1 below depicts the microwave links in the Los Angeles area in the Lower 6 GHz (5,925-6,425 MHz) and Upper 6 GHz (6,525-6,875 MHz) bands. In the Lower 6 GHz band, 22 licensees are using the band for 315 channels on 129 links; certain 30 MHz channels have been re-used up to 27 times in the Los Angeles area. In the Upper 6 GHz band, 26 licensees are using the band for 286 channels on 148 links with re-use up to 14 times per 10 MHz channel. In addition, there are 46 C-Band transmit earth station sites located in the Los Angeles area also sharing the Lower 6 GHz band.

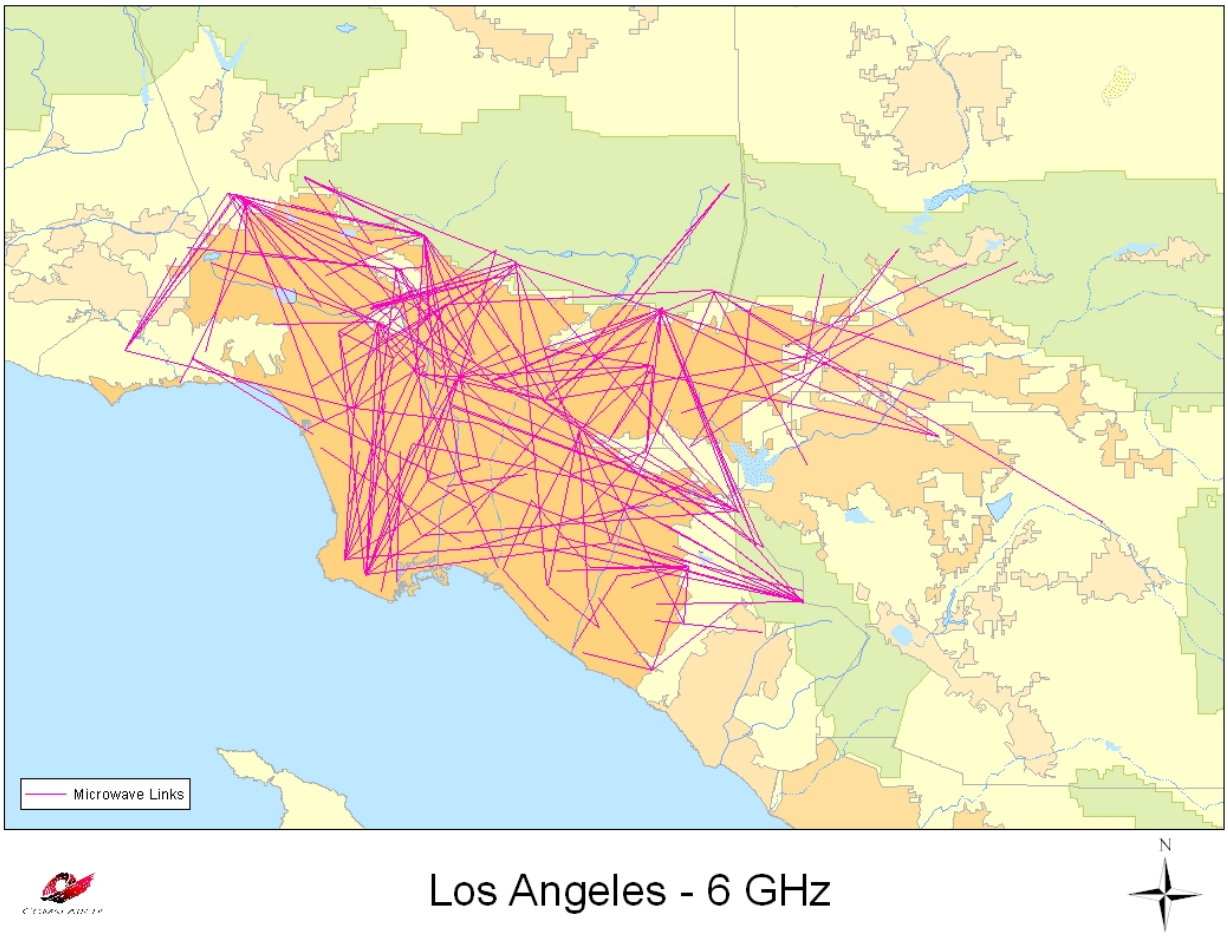

Figure 1: 5,925-6,425 MHz and 6,525-6,875 MHz Links in Los Angeles (Comsearch Data; October, 2010)

Antenna Standards. Under the WSI proposal, the worse the radiation pattern of an antenna that is coordinated on a link, the greater the coverage and protection area that is created for any auxiliary stations that are to be operated – a clear disincentive for licensees to utilize more efficient antennas in order to improve spectrum efficiency. Section 101.115(b) of the Commission's rules establishes directional antenna standards designed to maximize the use of microwave spectrum while avoiding interference between operators.[12] More specifically, Part 101 sets forth certain requirements, specifications, and conditions pursuant to which FS stations may use antennas that comply with either the more stringent performance standard in Category A or the less stringent performance standard in Category B.[13] The radiation pattern of the antenna is thus an important parameter in determining interference from or into a licensed link.

The breakpoints the rules specify for the Category A pattern set the minimum allowed antenna performance in congested areas.[14] Under traditional Part 101 licensing, antennas must meet Category A at all points, so as a consequence they exceed and in some cases greatly exceed the required performance at some angles or ranges of angles. Frequency coordination, and therefore the spectral efficiency that is achieved in the fixed service bands, takes advantage of the actual pattern envelope specified by the antenna manufacturer. For point-to-point service, licensees have no incentive aside from cost to use other than the best pattern antenna available to make their system compatible with the environment. The proposal to authorize auxiliary stations unavoidably introduces an opposite incentive – the worse the antenna pattern that is coordinated

[12] 47 C.F.R. § 101.115(b).

[13] *See id*. at § 101.115(b)-(d).

[14] FCC designated "congested areas" only in the upper 6 GHz band in the early 1980s. The lower 6 GHz and upper 6 GHz bands can now be considered congested in many areas of the country.

on a link, the greater the coverage and protection area or the more radiated power in the side lobes that is created for any auxiliary stations that are to be operated. For example, the prior coordination notices and licenses that have been issued thus far for systems implementing the WSI concept have each specified hypothetical antennas whose pattern points are the Category A breakpoints. Thus instead of representing the *minimum performance* that a real antenna intended for point-to-point service should meet at all points, Category A becomes the *specified performance* level for systems with auxiliary stations.

The pattern performance comparison in Figure 2 below shows that using the Category A points to coordinate these systems does great harm to efficient use of the spectrum. The standard performance antenna, model PAR6-59, meets Category A at all points and provides some advantage versus Category A in most directions. The ultra-high performance antenna, model UHX6-59, provides a large advantage over Category A in nearly every direction. These advantages over Category A are used every day to clear new proposals. Furthermore the actual measured performance of an antenna includes a peak-and-null sidelobe pattern and the radiation pattern envelopes ("RPE") manufacturers publish are drawn over the peaks of the measured performance.[15] Thus in some instances it may even be possible to take advantage of performance that surpasses the published RPE.

Using the Category A breakpoints to coordinate negates the advantage real directional antennas are capable of providing. The portrayal of an antenna that just meets Category A as a good antenna is not accurate. It is a minimally acceptable antenna for congested areas and the practice of attempting to coordinate the Category A pattern on systems with auxiliary stations is tantamount to intentionally creating excessive sidelobe radiation to enable the envisioned

[15] For example, nulls may be measured at twenty to thirty decibels below the level of the published RPE.

auxiliary service. To the extent an antenna's performance is better than Category A, the potential for interference is greatly reduced, and the ability to re-use the spectrum is greatly increased; however, the ability to use auxiliary stations would be impaired.

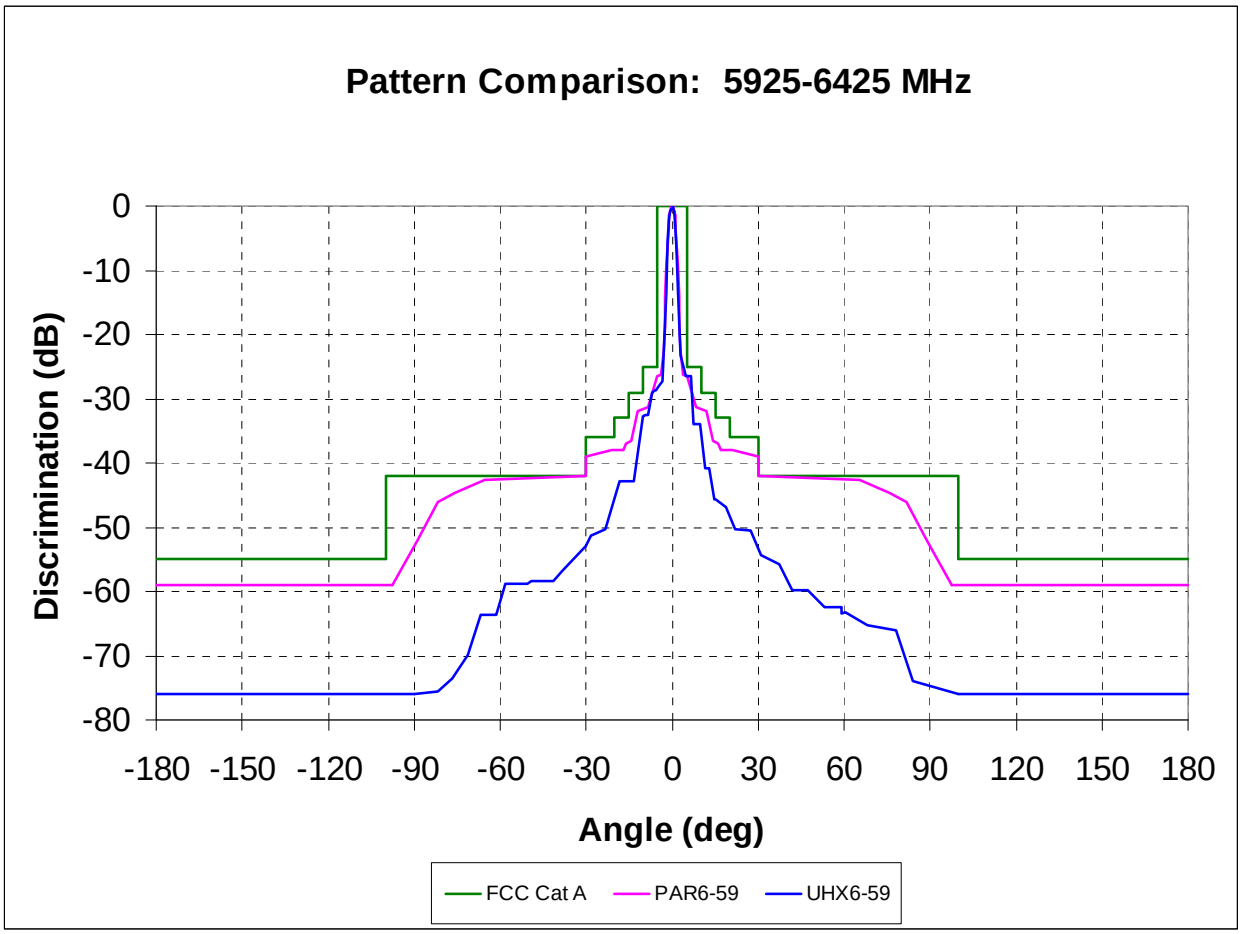

Figure 2: Category A Breakpoints;
Standard and Ultra High Performance Radiation Pattern Envelopes

2. The Auxiliary Station Proposal Would Provide Incentives To Use More Power than Necessary

In addition to specifying minimally compliant antennas, systems implementing the WSI concept also have listed very high transmitter power levels to cause the EIRP of the stations being licensed to reach the maximum EIRP the rules allow under any circumstance, 85 dBm. These excessive transmitter powers do not appear to have anything to do with enabling reliable

communication on the licensed link and thus appear to be in conflict with Section 101.113(a) of the rules that requires use of the "minimum amount of power necessary to carry out the communications desired."[16] Instead, under the WSI approach, the power is set as high as possible to create the maximum operating room for auxiliary stations. The fact that each known example of the WSI approach has specified EIRP near the 85 dBm maximum should be viewed in contrast with the distribution of EIRPs licensed on real point-to-point links shown in Figure 3. The vast majority of "real" links have EIRPs at least 10 to 20 dB lower than 85 dBm. Licensees of these links are using only the power necessary to communicate in compliance with Section 101.113(a). Taken together, the use of minimally performing antennas and excessive transmitter powers results in the potential for increased interference and is an inefficient use of the spectrum.

[16] 47 C.F.R. § 101.113(a).

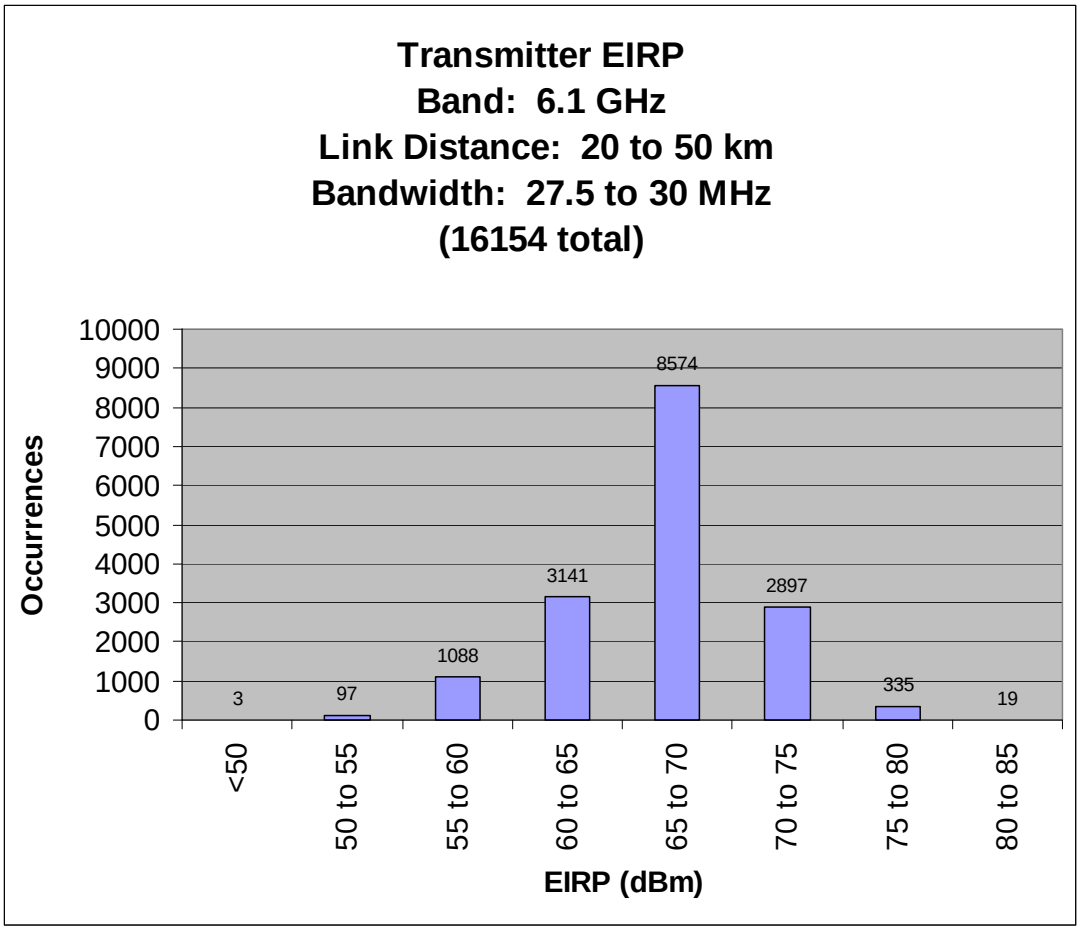

Figure 3: EIRP Distribution for 5,925-6,425 MHz Digital Transmitters (Comsearch data; October, 2010)

3. The Proposal Would Result in the Inappropriate Mixing of TDD and FDD in the Same Areas

The Commission recognizes that systems with auxiliary stations would most likely be operating with time-division duplexing ("TDD") and time-division multiple access ("TDMA"), which will increase the likelihood of interference to current and future frequency division duplexing ("FDD") point-to-point links.[17] Systems that have been proposed using the WSI approach involve licensing a frequency pair to both transmit and receive at each end of a link, apparently in order to accommodate TDD/TDMA operation. In contrast, point-to-point microwave systems under Part 101 universally operate on a FDD basis. While the Commission understandably tries to avoid favoring one technology over another, the reality is that, based on more than fifty years' history and the extensive listing of "Go" and "Return" channel plans in Section 101.147 of the rules, Part 101 point-to-point microwave has developed as an FDD service.[18]

Recently there have been numerous debates on mixing TDD and FDD systems in the same area on adjacent channel blocks in the context of mobile service.[19] In these debates the difficulty of *adjacent-channel* sharing between the two types of systems is recognized, although some parties claim operation is possible under certain circumstances.[20] At a minimum, though,

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[17] *See NPRM/NOI* at ¶ 52.

[18] *See also id*. at ¶ 6 ("The Commission has licensed spectrum for microwave uses for most of its history.") (citation omitted).

[19] *See generally* In the Matter of Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, *Further Notice of Propose Rulemaking*, WT Docket Nos. 07-195 and 04-356, 23 FCC Rcd 9859 (2008) (debate over use of AWS-3 spectrum by TDD systems in a band adjacent to FDD operators).

[20] *See, e.g.*, WiMax Forum, *Managing TDD-FDD Interference between Co-Sited Base Stations deployed in Adjacent Frequency Blocks*, *available at* http://www.wimaxforum.org/sites/wimaxforum.org/files/

it is difficult to see the public interest benefits of *co-channel* sharing of TDD and FDD systems in the same area, but that is effectively what is being proposed for the fixed service under the auxiliary station proposal.

Frequency planning is especially difficult or impossible if transmitters and receivers that operate on the same frequency are to be co-located or located in close proximity to each other, such as with mixing TDD and FDD systems. Co-located TDD systems may be able to share with each other if their technologies allow mutual timing of the transmit and receive time slots. FDD systems share with each other by following matched high/low frequency plans, so co-channel transmitters and receivers are not co-located. In a mixed TDD/FDD environment, however, an FDD system requires access to the channel all of the time so an analysis must assume a TDD system is a constant interference source. Therefore the only solution for the systems to operate co-channel – and the likely solution for the systems to operate adjacent channel – is to separate them into different areas. Whereas FDD systems can re-use a channel pair multiple times at a common site, the presence of a TDD system would most likely preclude the site for any future use by FDD systems, thus undermining spectral efficiency. TDD systems have their advantages (*e.g.*, efficiency on links where the offered traffic is asymmetrical), and Comsearch does not claim that FDD is superior; but adopting rules that would encourage deployment of TDD systems mixed with FDD systems on the same frequencies in the same areas is not good spectrum policy and should be rejected.

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document_library/FDD-TDD_Interference_analysis_involving_WiMAX_systems_Final_091103.pdf, November 3, 2009.

While impressive claims regarding the number of auxiliary links that would be supported have been filed,[21] implementing auxiliary links appears to involve *dividing* the channel resource (most likely in time) rather than *re-using* the channel. If auxiliary links share the channel resource by operating during specified time periods, then a claim of a re-use factor equal to the number of auxiliary links is erroneous. Most significantly, it appears necessary to turn off the main link transmitter in order to receive the signal from the auxiliary transmitters. Thus it does not appear possible to transmit to multiple auxiliary stations while also simultaneously transmitting on the main link. To the extent the main link is shut down during time slots used for auxiliary link traffic, communications over the main link may not meet the required payload. There is no valid interpretation of Section 101.141 that would authorize operation of a licensed main link that actually meets the capacity requirements only part of the time or particularly none of the time. The FCC therefore should not allow auxiliary stations because proponents are unable to prove that there is a tangible gain in efficiency versus traditional point-to-point licensing, taking into account the high coordinated power, poor antenna patterns, and division of channel resources these systems involve.

4. Secondary Status Would Not Resolve Interference Concerns

To the extent the FCC goes forward with its proposal whereby auxiliary stations are to be added under licensed main links, the FCC's associated proposal that they should be coordinated is essential but not sufficient. There is a misperception that auxiliary links cannot be harmful if they are coordinated and are of secondary status. However, adding auxiliary stations places a

[21] *See* Attachment to Letter from Michael Mulcay, Chairman, Wireless Strategies Inc., to Marlene Dortch, Secretary, Federal Communications Commission, July 30, 2010, WT Docket No. 07-121, at 19 ("A typical 4G deployment has 100 base stations within an area of a six mile radius. By using the sidelobe radiation around a Fixed Services licensed station the 100 base stations can be backhauled with just one frequency, conserving approx. 5800MHz of Spectrum compared to Legacy Paths and at a Cost 80% Less than a Legacy deployment.").

large and potentially costly burden on incumbents to protect their systems from the auxiliary stations in the coordination process and possibly through a program of interference measurements. Identifying and remedying an interfering source is extremely difficult and costly to quantify. Today, even with systems using high performance and even ultra-high performance antennas and every interference reducing counter-measure available (Automatic Transmit Power Control or ATPC), interference does occur; and the time, cost, and effort to find the interferer can be extremely burdensome; actual interference from numerous auxiliary stations would greatly exacerbate the problem.

The purported benefits of auxiliary stations for wireless backhaul also must be questioned. Auxiliary stations would be secondary and supposedly would be required to shut down in response to coordination of a subsequent primary link or even unpredicted interference that could be received by a primary link. Because cell sites served by auxiliary stations would be at risk of having the backhaul service interrupted as a result of ongoing licensing activity, it may not be prudent for carriers to rely on auxiliary stations licensed on a secondary basis for backhaul, thereby undercutting the rationale for adopting the proposed rules. More significantly, if public safety organizations were to take advantage of the auxiliary stations approach, the realities associated with requesting the turn-down of a public safety or critical infrastructure network would be problematic.

5. Specific Bands Already Are Identified for Point-to-Multipoint Use

The Commission long ago identified the potential benefits associated with deploying point-to-multipoint radios and recognized that the traditional site-by-site licensed bands were ill-suited for that purpose. Instead, the Commission developed specific bands for multipoint use, provided licensees with flexible operating requirements, and auctioned licenses on an area-wide

geographic basis.[22] It is clear that systems with auxiliary stations in bands should be located in the bands with area licensing such as 24 GHz, LMDS and 38 GHz and not in the already-congested point-to-point bands.

II. RULES PERMITTING ADAPTIVE MODULATION SHOULD NOT ENCOURAGE DEPLOYMENT OF LOWER PERFORMANCE ANTENNAS

Using adaptive modulation to keep a well-designed link operating through periods it would otherwise be unavailable is a worthy objective. However, in crafting any rule change the Commission must take into account the possibility that adaptive modulation may be used not only to satisfy this objective but also to implement links that are designed to a lower standard than is presently used.[23] The *NPRM/NOI* proposes to allow licensees to operate links below the Section 101.141(a)(3) required payload capacity during periods of "anomalous signal fading."[24] The change is intended "to allow FS licensees to maintain communications when adverse propagation characteristics would otherwise force communications to be terminated."[25] The consequence of a fade exceeding the link margin with fixed modulation – unavailability due to link disconnection and the wait time to reconnect – is more severe than the reduced capacity that would occur under adaptive modulation. Therefore, if permitted to do so, those designing a link

[22] *See* generally Amendments to Parts 1, 2, 87 and 101 of the Commission's Rules To License Fixed Services at 24 GHz, *Report and Order*, 15 FCC Rcd 16934 (2000); *Erratum*, 19 FCC Rcd 9846 (2004); Rulemaking To Amend Parts 1, 2, 21, and 25 Of the Commission's Rules to Redesignate The 27.5-29.5 GHz Frequency Band, To Reallocate the 29.5-30.0 GHz Frequency Band, To Establish Rules and Policies for Local Multipoint Distribution Service And Fixed Satellite Services, *Second Report and Order, Order on Reconsideration and Firth Notice of Proposed Rulemaking*, 12 FCC Rcd 12545 (1997); Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40 GHz Bands, *Report and Order and Second Notice of Proposed Rule Making*, 12 FCC Rcd 18600 (1997).

[23] Links using fixed modulation radios in the 5,925-6,425 MHz, 6,525-6,875 MHz and 10,700-11,700 MHz bands are generally designed to meet 99.999% availability or better. This constitutes the present design standard in our view.

[24] *NPRM/NOI* App. A Proposed Rules at 14 (§101.141(a)(3)).

[25] *Id*. at ¶ 28.

may accept greater time of reduced capacity under adaptive modulation than they would accept time of unavailability under fixed modulation.

If the use of adaptive modulation is permitted in such a way that a relaxation in the *de facto* standard of path design occurs, the Commission should be aware that operators are likely to select smaller and lower performance antennas overall. Since less fade margin is required with adaptive modulation, designers may accept potential degradation due to interference rather than use higher performance antennas. Whether the shift in design standards, including enabling the selection of lower performance antennas, is beneficial depends on perspective – although each link may be less costly, the savings would come at the expense of the density of links that can be coordinated and ultimately how efficiently the spectrum is used.

Fading that would be exceeded only a small percentage of the time is always deep and thus could reasonably be considered "anomalous," no matter whether the time percentage is 1%, 0.1%, 0.01%, or 0.001%. But a shift of an order of magnitude, for example relaxing the design objective for availability from 99.999% to 99.99% (relaxing the unavailability objective from 0.001% to 0.01%), has a large impact in terms of reducing the fade margin that is required. For deep multipath fading without diversity, an order of magnitude reduction in the availability objective requires 10 dB less fade margin.

Anomalous Signal Fading. Comsearch believes that the condition that "anomalous signal fading" is required in order to shift to a modulation that does not meet the required payload capacity is not specific or restrictive enough to prevent a lowering of design standards. For example, this condition would not prevent implementation of a link that would shift to a modulation below the Section 101.141(a)(3) limit 0.1% of the time, even though such a link would be a very poor design. The motivation for designing such a link would be that only

minimal capacity is really needed, and equipping radios with adaptive modulation allows use of a higher channel bandwidth and a simpler modulation for improved system gain. However, the purpose of Section 101.141(a)(3) is to require lower capacity systems to use narrower channels (or higher frequency bands), and such a link would thus represent an attempt to use adaptive modulation to circumvent the requirement. Beyond such instances where adaptive modulation could be used to directly circumvent the payload capacity requirements, relaxation of design objectives with adaptive modulation, if permitted, could become widespread and could lead to less efficient spectrum usage due to an overall drop in antenna performance.

To avoid this risk, Comsearch recommends that additional requirements for path design with adaptive modulation should be added to Section 101.141(a)(3) (suggested text underline):

> The following capacity and loading requirements must be met for equipment applied for, authorized, and placed in service after June 1, 1997 in 3700-4200 MHz (4 GHz), 5925-6425, 6525-6875 MHz, and 6875-7125 MHz (6 GHz), 10,550-10,680 MHz (10 GHz), and 10,700-11700 MHz (11 GHz) bands, except during anomalous signal fading. During anomalous signal fading, licensees may adjust to a modulation specified in their authorization if such modulation is necessary to allow licensees to maintain communications, even if the modulation will not comply with the capacity and loading requirements specified in this paragraph. <u>Links that use equipment capable of adjusting modulation must be designed using generally accepted multipath fading and rain fading models to meet the specified capacity and loading requirements at least 99.999% of the time, except links that use Category A antennas may be designed to meet the requirements at least 99.995% of the time.</u>

Comsearch also recommends the following conditions to minimize the effect on receivers of other licensees that may be subject to potential interference from adaptive modulation transmitters:

- Transmitters should be designed to maintain a constant power spectral density, as expressed by the emission designator, through all possible modulation shifts; and
- The transmitter power for coordination and licensing should correspond to a modulation level that meets the §101.141(a)(3) payload capacity.

Prior Coordination Notices. The *NPRM/NOI* proposes adding a requirement to the information that must be included in prior coordination notices: "Notification shall indicate if modulations not compliant with the standards contained in § 101.141(a)(3) of the Commission's rules will be used."[26] This new requirement is reasonable but unnecessary because notices are already required to indicate the emission designator (bandwidth) and loading (payload) of the proposed system(s). Whether or not the rule on payload capacity is satisfied will be explicit from these items, so Comsearch recommends no change to Section 101.103(d).

III. PERMITTING GREATER SHARING BETWEEN FS, BAS, AND CARS IS GOOD POLICY BUT RAISES SOME TECHNICAL CONCERNS

Comsearch agrees with the *NPRM/NOI* that it should be possible to coordinate shared usage of fixed systems in the 6875-7125 MHz ("7 GHz") and 12,700-13,200 MHz ("13 GHz") bands among Part 74, Part 78, and Part 101 users under the Section 101.103(d) notification-and-response procedures. However, the exemption of mobile (temporary fixed) stations from these procedures (and the use, instead, of less formal local coordination procedures) will make it difficult for Part 101 users to share the bands.[27]

Specifically, Part 101 users may not find the proposed method of coordination with Broadcast Auxiliary Service ("BAS") mobile (temporary fixed) uses to be sufficiently rigorous to protect their systems. In addition, Part 74 local coordinators may be unable to take on the additional responsibility of coordinating with Part 101 fixed systems. To enable co-channel

[26] *Id*., App. A Proposed Rules at 9 (§101.103(d)(2)(ii)).

[27] *See* 47 C.F.R. §74.638(d): "Frequency coordination for all mobile (temporary fixed) stations in all bands above 1990 MHz, except the bands 6425–6525 MHz and 17.7–19.7 GHz. For each frequency authorized under this part, applicants are responsible for selecting the frequency assignments that are least likely to result in mutual interference with other licensees in the same area. Applicants may consult local frequency coordination committees, where they exist, for information on frequencies available in the area. In selecting frequencies, consideration should be given to the relative location of receive points, normal transmission paths, and the nature of the contemplated operation."

sharing in these bands, it is necessary to devise an effective coordination method that would both protect fixed systems with precise interference analysis and also allow near real time access to channels for electronic news gathering ("ENG") requirements.

An approach that may have some merit is segmenting the bands into a group of channels only available for fixed usage, to be shared with Part 101, and another group available for fixed and mobile (temporary fixed) usage. By adding new plans of channels narrower than the existing 25 MHz, there appears to be an opportunity to increase the number of channels available that are capable of transporting digital video signals by a factor of two to three or possibly more. This increase in efficiency could make a segmentation approach feasible while maintaining or increasing the flexibility of BAS systems including ENG. In the 13 GHz band, there already is a preference given to ENG systems in the 13.15-13.2 GHz segment within 50 km of the top 100 television markets.[28] If this preferred segment is sufficient to satisfy mobile BAS needs for 13 GHz, particularly if it is subdivided into multiple channels, then 13 GHz may be a better candidate band for sharing with Part 101 than 7 GHz.

The *NPRM/NOI* proposes adding a large number of narrow channels of 400 kHz, 800 kHz, 1.25 MHz, 2.5 MHz, and 3.75 MHz to the 7 and 13 GHz bands under Parts 74 and 101.[29] Addition of such narrow channels may not be of much utility in the Part 74 TV BAS service since they are too narrow to accommodate a digital video signal.[30] Furthermore, in light of increasing backhaul capacity needs per cell site, which the Commission has recognized in this proceeding, these channels are too narrow to be very useful under Part 101.[31] Use of narrow

[28] *See* 47 C.F.R. §74.602(a).

[29] *See NPRM/NOI* at ¶¶ 18-49 and App. A Proposed Rules at 4 (§ 74.602).

[30] A 20 Mb/s video signal may fit in a 3.75 MHz channel with 128 QAM modulation; however broadcasters have not commonly chosen to use such high order modulations.

[31] *See NPRM/NOI* at ¶ 4.

channels is limited in bands where they are already available such as 6 and 10 GHz, because the channels do not offer sufficient capacity even when high order modulations are used. The Commission should acknowledge this trend and either delete these narrow channel plans entirely or minimize the number of added narrow channels.

The proposed rules also include 10 MHz and 30 MHz channel plans for the 7 and 13 GHz bands. Channels of these bandwidths are regularly used in the 5,925-6,425 MHz, 6,525-6,875, and 10,700-11,700 MHz bands. Adding them for 7 and 13 GHz makes sense from the perspective of Part 101 users since existing radio modem technology would transfer to the new bands. On the other hand, from the perspective of Part 74 users, other channel bandwidths derived from even divisions of the existing 25 MHz channel plans may be more useful. For example, the 2 GHz BAS band has been re-channelized for seven 12 MHz channels in the 2,025-2,110 MHz segment. Dividing the 25 MHz channels into 12.5 MHz channels may allow digital radio technology developed for 12 MHz channels at 2 GHz to transfer to 7 and 13 GHz. Similarly, several radio modem products have been developed for the BAS market to transport digital video in channel bandwidths of 6 to 8 MHz using vestigial sideband ("VSB") or coded orthogonal frequency division multiplexing ("COFDM") modulation schemes. Dividing the 25 MHz channels by three to overlay a plan of 8.33 MHz channels would provide a more efficient home for these radios, whereas placing them on the 10 MHz plan would be somewhat inefficient and using the proposed 5 MHz plan would require different radios with higher order modulation. If sharing of the 7 and 13 GHz bands goes forward, the FCC should consider the needs of both Part 101 and Part 74 users in selecting the channel plans. On the other hand, to the extent Part 101 sharing in 7 and 13 GHz is deemed infeasible, the Commission should still re-channelize the bands for the sake of efficient Part 74 usage.

The *NPRM/NOI* requests comment on adding Category A antenna breakpoints to Section 101.115 for the 6,875-7,125 MHz band that are the same as the Part 101 breakpoints for the 5,925-6,425 MHz and 6,525-6,875 MHz bands.[32] However, different standards would apply depending on the class of user since Part 74 has a different Category A pattern. For parity, Comsearch recommends harmonizing this requirement between Part 74 and Part 101. In the same vein the Commission should consider a payload capacity standard for Part 74 fixed links that requires efficiency (bps/Hz) similar to Section 101.141(a)(3) of the rules.

Finally, unless a solution can be found to effectively share 7 and 13 GHz, such as through segmentation of mobile uses, plus coordination as proposed in the *NPRM/NOI* , then perhaps the most efficient use of the spectrum is to maintain the "final link" rule of Section 101.603(a)(7). If other services cannot effectively share with BAS, then continuing the existing sharing between BAS studio-to-transmitter links and TV pickup (ENG) operations appears to be the best possible situation.

IV. QUESTIONS RAISED IN THE NOI WOULD BENEFIT FROM FURTHER STUDY

A. Efficiency Standards in Rural Areas

Comsearch supports the Section 101.143(a)(3) payload capacity requirements as an important component of the Commission's efforts to encourage efficient spectrum use. The microwave bands in general, and the 6 GHz bands in particular, are becoming more and more congested even in less populated areas. Therefore Comsearch is reluctant to recommend relaxing the efficiency standards, even though it acknowledges, as noted in the *NPRM/NOI,* that there would undoubtedly be cost savings if lower payloads were allowed.[33] As usage grows,

[32] *NPRM/NOI* at ¶¶ 60-67.

[33] *Id*. at ¶ 60.

however, adding inefficient links will hasten the transformation of a clear area into a congested area. Thus, if the Commission finds support for lowering the efficiency standards in rural areas, the rule changes should be crafted as narrowly as possible to limit the number of inefficient paths.

The definition of rural areas proposed in the *NPRM/NOI* is based on population density by county.[34] In selecting a definition of rural areas where less bandwidth-efficient systems would be allowed, the Commission should recognize that population alone is not a sufficient criterion. For microwave services, sites such as hilltops or mountaintops that have good visibility to allow line-of-sight over long distances are very desirable. In addition, policies of the FCC and other federal, state, and local government agencies, as well as other economic factors, encourage licensees to co-locate rather than develop new radio sites. As a result of such technical, economic, and regulatory factors that encourage licensees to co-locate, there are a large number of sites that are highly congested in terms of microwave usage that are nevertheless "rural" in terms of population density. At these congested sites, it is necessary to maintain the Section 101.141(a)(3) capacity standards in order to conserve spectrum and facilitate maximum re-use. The definition of "rural" for relaxing microwave efficiency standards in rural areas thus should take into account not only population density as proposed but also how many microwave stations are licensed nearby.

B. Review of Part 101 Antenna Standards

Using smaller antennas as suggested in the *NOI* can result in an increase in interference potential as a result of the wider beamwidth, reduced sidelobe suppression, and possibly worse

[34] *Id.* at ¶ 63.

front-to-back ratio that smaller antennas entail.[35] While wider beamwidth and reduced suppression of the sidelobes near the main beam are an unavoidable consequence of smaller antennas, we believe it is possible to design smaller antennas, within reason, that still have good suppression of the farther sidelobes and good front-to-back ratio. On the other hand if the antenna diameter is too small relative to the frequency band where it is used, it can become impossible to engineer good pattern performance. Allowing smaller antennas by relaxing the beamwidth and required suppression breakpoints near the main beam, as necessary, while at the same time tightening the farther breakpoints can be a reasonable tradeoff for spectral efficiency and meeting the goals of lower cost, ease of installation, and less obtrusive appearance.[36]

The rules have already been modified to allow two-foot diameter antennas in the 10,550-10,680 MHz and 10,700-11,700 MHz bands, and we believe that this is the minimum size for good pattern performance in these bands. Beyond that we recommend the following revisions to the Section 101.115 antenna standards to allow smaller antennas in three specific cases:

- Relax the 18 GHz Category B gain and beamwidth and slightly relax the required suppression from 5º to 60º while tightening the required suppression from 60º to 180º to allow one-foot diameter high-performance antennas;

- Relax the 23 GHz Category B gain, beamwidth, and required suppression from 5º to 45º while tightening the required suppression from 45º to 140º to allow 8-inch diameter high-performance antennas; and

- Relax the 6 GHz Category B gain and beamwidth and slightly relax the required suppression from 5º to 30º while tightening the required suppression from 60º to 180º to allow 4-foot diameter high-performance antennas.

In addition, we note that the Part 101 antenna standards have been adjusted in a few cases but have not undergone an overall review in many years. We recommend that the FCC should

[35] *See id.* at ¶¶ 64-67.

[36] *Id.* at ¶ 64 ("Smaller antennas may be cheaper, easier to install, and generate fewer objections than antennas specified by the current requirements.").

implement such a review to revise the standards to make them reflect the proper current balance of manufacturing capabilities, spectral efficiency, and cost. For example, the ETSI standards are recent and require significantly greater suppression of the far sidelobes and significantly greater front-to-back ratio than the FCC standards.[37] It is our understanding that the ETSI requirements are followed by manufacturers for the worldwide market, and it is reasonable to improve the FCC requirements to the level of these standards where possible. In reviewing the antenna standards the FCC should implement the following points:

- Change the format of the Section 101.115 table to use breakpoints connected by straight line segments rather than the ranges at a constant suppression level that lead to a "stairstep" pattern;

- Introduce standards for suppression of cross-polarized signals to emphasize the independent use of the two polarizations (vertical and horizontal) as separate channel resources; and

- Improve the Category B and Category A suppression requirements as much as possible consistent with the size of antennas intended to be allowed and the expected price points.

The specific pattern requirements for smaller antennas in the cases we have recommended and a full review of the antenna standards should be considered with full industry input.

We also note that any increase in interference potential of smaller antennas can be minimized or perhaps eliminated if stations use lower EIRP corresponding to the reduction in antenna gain. It is our understanding that such EIRP reduction represents a common usage when the radio and its transmitter power level are predetermined; however, no present rule prevents connecting a smaller antenna to a higher power transmitter to maintain the EIRP and thus increase the interference potential. In the future, if a trend emerges of use of increased

[37] *See* ETSI EN 302 217-4-2 V1.5.1 (2010-01).

transmitter power with smaller antennas, it may be necessary to make a rule to limit this use, such as a schedule of allowed transmitter power or EIRP versus antenna mainbeam gain.

In WT Docket No. 07-54, the FCC added Section 101.115(f) that endorses for the first time reducing station EIRP as a means of resolving an interference conflict caused by the use of a Category B antenna, as opposed to replacing the antenna with a model meeting Category A.[38] Unfortunately, the final rule language does not accomplish its intended purpose. Section 101.115(f) requires:

> In the 10,700–11,700 MHz band, a fixed station may employ transmitting and receiving antennas meeting performance standard B in any area. If a Fixed Service or Fixed Satellite Service licensee or applicant makes a showing that it is likely to receive interference from such fixed station and that such interference would not exist if the fixed station used an antenna meeting performance standard A, the fixed station licensee must modify its use. Specifically, the fixed station licensee must either substitute an antenna meeting performance standard A or operate its system with an EIRP reduced so as not to radiate, in the direction of the other licensee, an EIRP in excess of that which would be radiated by a station using a Category A antenna ***and operating with the maximum EIRP allowed by the rules.***

The highlighted text negates the intent of the rule. Figure 4 below shows that the EIRP typically used by 11 GHz stations is far below the Part 101 maximum, 85 dBm. Most stations use EIRP less than 60 dBm. If the mainbeam EIRP of a station using a Category B antenna is significantly lower than 85 dBm, then the station's EIRP in every direction is already lower than it would be for an 85 dBm transmitter – the maximum EIRP allowed by the rules – suppressed by the amount required by the Category A breakpoints. Therefore the rule language does not effectively require any modification at all to the station using a Category B antenna.

[38] *See* Amendment of Part 101 of the Commission's Rules to Modify Antenna Requirements for the 10.7-11.7 GHz Band, *Report and Order*, WT Docket No. 07-54, 22 FCC Rcd 17153 (2007).

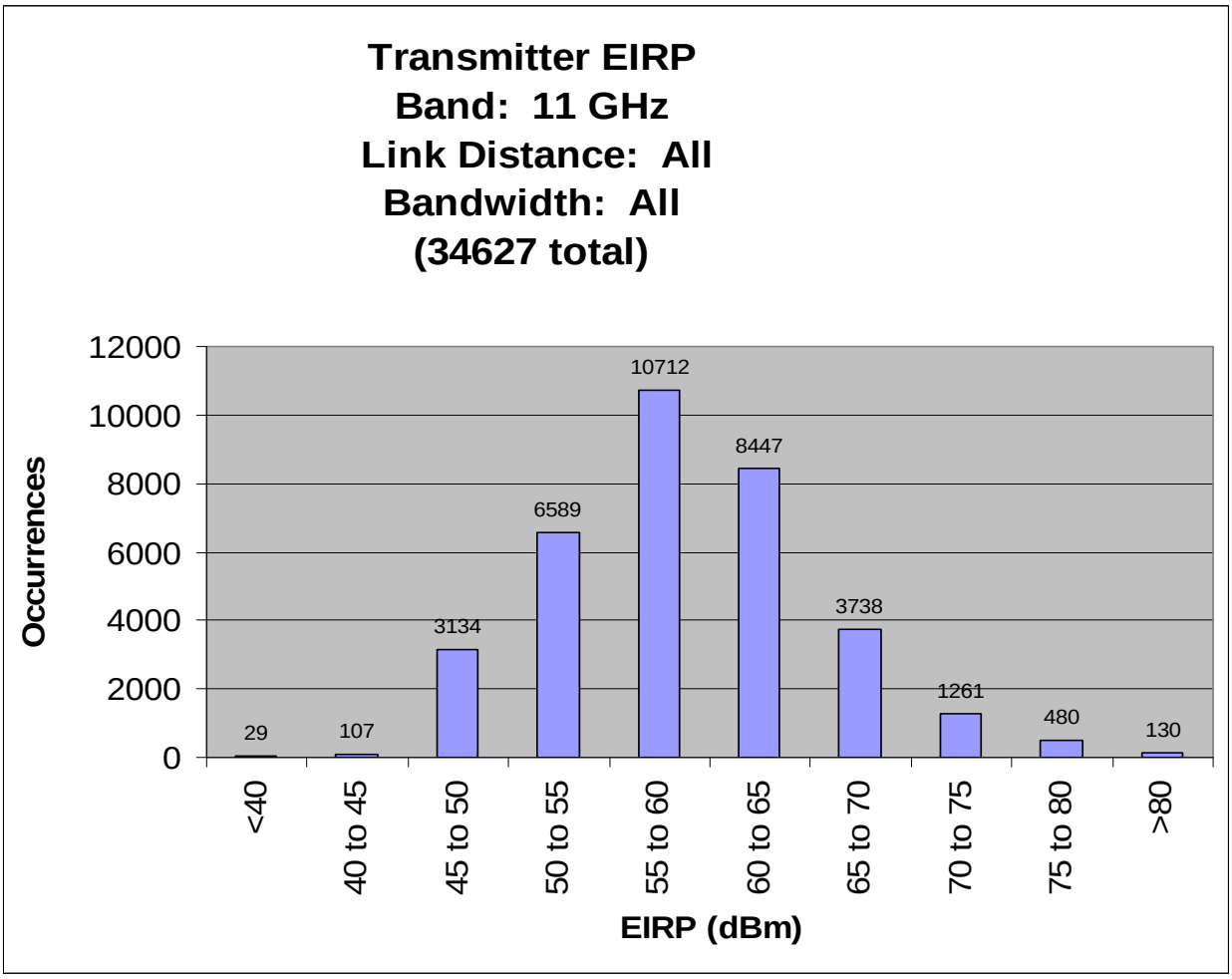


Figure 4: EIRP Distribution for 10,700-11,700 MHz Digital Links (Comsearch data; October, 2010)

In our consideration of the EIRP reduction concept in WT Docket No. 07-54, we understood that a station using a Category B antenna would be required to either upgrade to a Category A antenna or reduce its EIRP towards the affected station to the level that would exist *with the licensed main-beam EIRP* (rather than the maximum EIRP allowed by rule) suppressed off-axis by the Category A breakpoints. Presumably the licensed EIRP would have been selected in conformance with the Section 101.113(a) requirement to use the minimum necessary power. Reducing the EIRP was added to give licensees a method of mitigating interference without increasing the size of the antenna, since that approach could be blocked by tower loading

conditions or zoning or appearance problems. Furthermore we believe our understanding was shared by proponents of this EIRP reduction concept in the proceeding. Whatever the misunderstanding that led to the present rule language, the FCC should promptly fix the rule to impose a real obligation on operators of Category B antennas to mitigate interference. The phrase "and operating with the maximum EIRP allowed by the rules" in Section 101.115(f) should be replaced by "and operating with the authorized EIRP." Strict enforcement of the requirements of Section 101.113(a) should also accompany any use of Category B antenna to ensure that licensees are not purposely using higher EIRPs to avoid the consequences associated with future interference cases that may require an EIRP reduction.

V. OTHER FCC ACTIONS CAN PROMOTE MORE FLEXIBLE AND EFFICIENT USE OF WIRELESS BACKHAUL SPECTRUM

In response to the Commission's request for any suggested modifications to the Part 101 rules, or other policies or regulations, to promote flexible, efficient and cost-effective provisions of wireless backhaul service,[39] Comsearch offers several suggestions.

A. Geostationary Orbital Intersections

The FCC should conform its rules to the requirements of the International Telecommunications Union ("ITU") Radio Regulations in order to reduce the circumstances under which applicants for point-to-point microwave must file waivers for antennas aimed near the geostationary arc.[40] Eliminating the filing of unnecessary waiver requests is a step the FCC can take to improve the efficiency of licensing links for backhaul. The potential for FS transmitters to cause interference to geostationary satellites is substantially an international

[39] *NPRM/NOI* at ¶ 68.

[40] *See* Article 21 - Terrestrial and space services sharing frequency bands above 1 GHz, ITU Radio Regulations.

sharing situation that should be governed by the ITU rules that are less restrictive than the FCC rules presently in force.

To protect receivers on geostationary satellites from the potential for interference from FS transmitters, Section 101.145 requires a waiver filing for: (1) FS transmitters in the 5925-7075 MHz range with an antenna aimed within 2º of the geostationary arc; and (2) FS transmitters in the 12,700-13,250 MHz range with an antenna aimed within 1.5º of the geostationary arc. To be approved, the waiver requests must show, among other things, that the transmitter EIRP is below listed limits. In contrast, Article 21 of the ITU Radio Regulations places the 2º restriction on the pointing azimuth of antennas of FS transmitters in the 1-10 GHz band *only if the EIRP is greater than 35 dBW*, and the 1.5º restriction on the azimuth of antennas in the 10-15 GHz band *only if the EIRP is greater than 45 dBW*.[41] The ITU recognizes there is an EIRP limit below which FS transmitters should not be able to degrade the performance of the satellite transponders and thus there is no need to restrict the azimuth of antennas below this limit.

Microwave antennas are generally installed with the main beam oriented horizontally towards the station at the other end of the link. Figure 5 below shows the distribution of antenna elevation angles for the Lower 6 GHz (5,925-6,425 MHz) and Upper 6 GHz (6,525-6,875 MHz) bands. Comsearch data shows 97% of the antennas are oriented with the main beam 2º above horizontal or lower.

[41] *Id.*

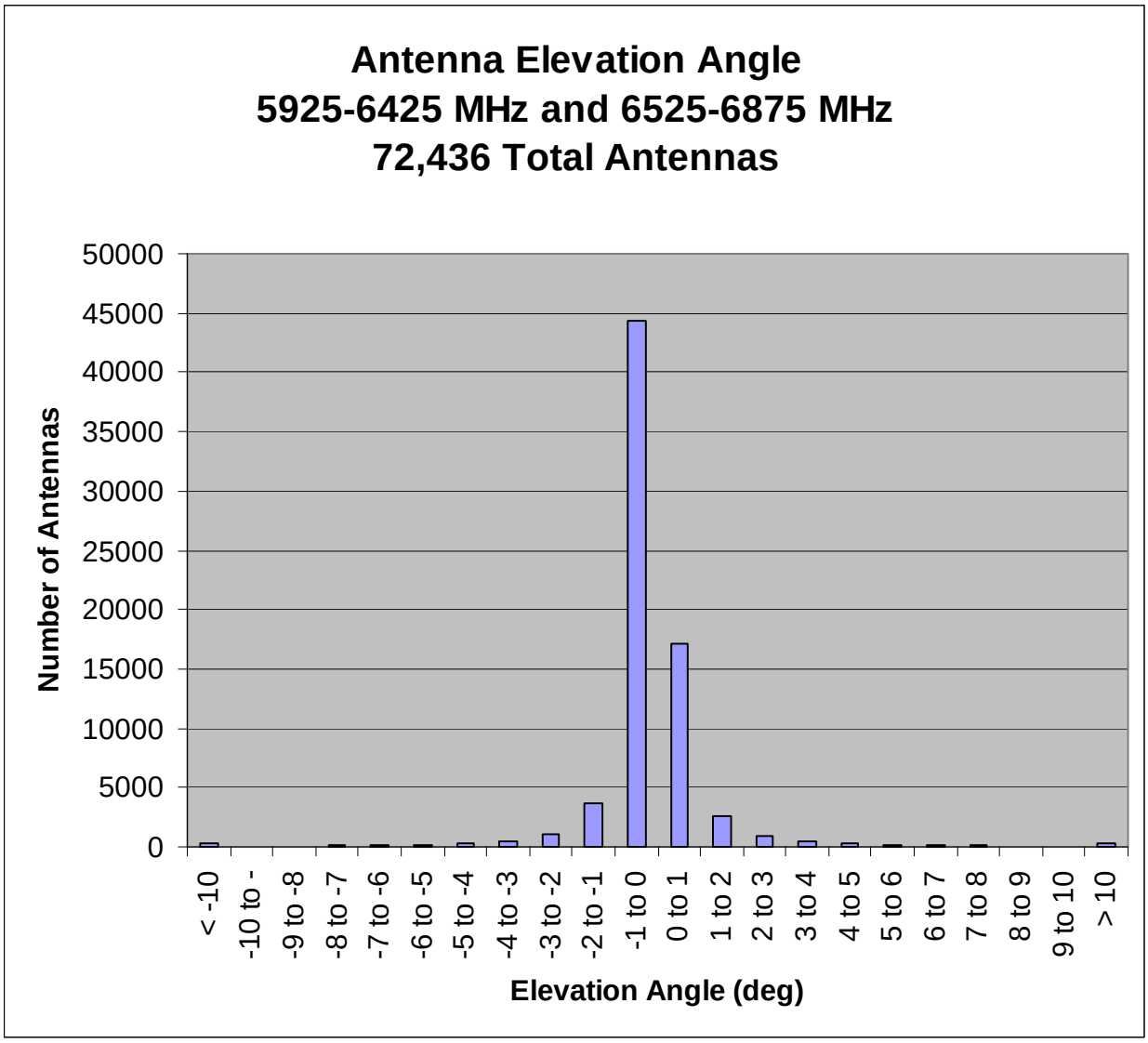


Figure 5: Distribution of FS Antenna Elevation Angles (Comsearch data, September, 2010)

For fixed service antennas at 0º elevation angle, Table B below shows the restricted azimuth ranges within 2º of the geostationary arc and the range of longitudinal satellite positions (above the equator) that corresponds to the range of restricted azimuths.

City	Restricted Azimuth Ranges	Satellite Longitude Ranges
Boston	94.8º to 100.4º and 259.6º to 265.2º	11.8º E to 3.6º E and 145.8º W to 154.0º W
Miami	91.6º to 96.3º and 263.7º to 268.4º	5.9º E to 4.6º W and 156.3º W to 166.7º W
Chicago	94.7º to 100.3º and 259.7º to 265.3º	4.6º W to 12.8º W and 162.4º W to 170.6º W
Dallas	92.8º to 97.8º and 262.2º to 267.2º	11.9º W to 21.0º W and 172.6º W to 178.4º E
Seattle	96.2º to 102.3º and 257.7º to 263.8º	40.7º W to 48.8º W and 164.1º E to 156º E
San Diego	92.8º to 97.8º and 262.2º to 267.2º	32.1º W to 41.1º W and 167.3º E to 158.2º E

Table B: Horizontal Antenna Beam Intersections with the Geostationary Arc

As also shown in Table B, the range of restricted azimuths is about 10º at any particular site. Therefore assuming the azimuth of desired transmission paths is uniformly distributed, about 3% of paths are impacted by the present waiver requirement. Figure 3 demonstrates that for paths of 20 to 50 km, and even more so for shorter paths, operating at EIRP 65 dBm (35 dBW) or below will be possible on many of the impacted 6 GHz paths and the need to file a waiver will be eliminated in many cases. At the same time, satellites will not experience harmful interference because of the low EIRP and low power density of the FS transmitters.

The satellite positions that are impacted are far to the east or far to the west of the longitude of the FS transmitter. For example, restricting the azimuth of a Boston antenna protects satellites at 3º to 12º E (over Europe and Africa) or at 145º to 154º W (over the Pacific Ocean, Hawaii, and Alaska). Similarly, restricting the azimuth of antennas anywhere in the continental U.S. will generally protect satellites over the Atlantic Ocean, Europe, and Africa, or over the Pacific Ocean. On the other hand, azimuth restrictions will provide only negligible protection for satellites over the U.S. from microwave transmitters in the U.S. – the fixed service transmitters that could impact satellites over the U.S. would by and large be located in other parts of the world.

FCC rules that are more restrictive than international requirements would make sense if they would provide additional protection to receivers of systems serving the U.S. Here, however, since any FS antenna in the U.S. aimed near the arc may only be authorized by waiver regardless of EIRP, the present rules have the reverse effect of restricting the fixed service in the U.S. in order to provide additional protection to satellites that for the most part serve other parts of the world. At the same time, satellites that primarily serve the U.S. do not receive reciprocal protection from foreign FS transmitters since those administrations would presumably follow ITU regulations. Furthermore the ITU, having studied the matter, has determined that transmitters below 35 dBW EIRP (1-10 GHz) and 45 dBW (10-15 GHz) should not be harmful to GSO satellite receivers, so the FCC requirement of a waiver filing for stations below these limits appears unnecessary. The present universal use of digital rather than analog microwave is an additional factor that mitigates the interference potential, since with digital microwave the transmitter EIRP is spread uniformly over a large bandwidth rather than being concentrated in a residual carrier as with analog.

To improve the administrative efficiency of licensing FS links for backhaul, the FCC should revise Section 101.145 (b) and (c) to add EIRP limits (additions underlined):

> (b) *2655 to 2690 MHz and 5925 to 7075 MHz.* No directional transmitting antenna utilized by a fixed station operating in these bands **with EIRP greater than 35 dBW** may be aimed within 2 degrees of the geostationary satellite orbit, taking into account atmospheric refraction. However, exception may be made in unusual circumstances upon a showing that there is no reasonable alternative to the transmission path proposed. If there is no evidence that such exception would cause possible harmful interference to an authorized satellite system, said transmission path may be authorized on waiver basis where the maximum value of the equivalent isotropically radiated power (EIRP) does not exceed:
>
> (1) +47 dBW for any antenna beam directed within 0.5 degrees of the stationary satellite orbit; or

(2) +47 to +55 dBW, on a linear decibel scale (8 dB per degree) for any antenna beam directed between 0.5 degrees and 1.5 degrees of the stationary orbit.

(c) *12.7 to 13.25 GHz.* No directional transmitting antenna utilized by a fixed station operating in this band **with EIRP greater than 45 dBW** may be aimed within 1.5 degrees of the geostationary-satellite orbit, taking into account atmospheric refraction. ~~However, exception may be made in unusual circumstances upon a showing that there is no reasonable alternative to the transmission path proposed. If there is no evidence that such exception would cause possible harmful interference to an authorized satellite system, said transmission path may be authorized on waiver basis where the maximum value of the equivalent isotropically radiated power (EIRP) does not exceed +45 dBW for any antenna beam directed within 1.5 degrees of the stationary satellite orbit.~~

B. Payload Capacity Requirements

With respect to payload capacity, both Section 101.141(a)(3) of the FCC's rules and the FCC Form 601 application form would benefit from additional clarification. For example, in Section 101.141(a)(3), radios are required to have a "minimum payload capacity" based on the channel bandwidth occupied; but "payload capacity" is not defined in Part 101. A suggested definition is found below.

The data that is transmitted over a radio link includes capacity that is available to carry traffic offered through the equipment interface(s) as well as overhead generated by the radios such as coding and forward error correction information. In some cases, the traffic interface(s) of the equipment are a limiting factor when not all of the radio link capacity is made available to the user. In addition, internet protocol ("IP") radio systems are now entering the market that use header compression techniques whereby repetitive overhead bits in the packets are stripped off at the transmit end of the link and reinserted at the receive end. By using this compression, the link may have an apparent data rate at the Ethernet interfaces that is higher than the rate at which data traverses the over-the-air radio path.

The most reasonable interpretation of Section 101.141(a)(3) appears to be that the payload capacity required by the rule should include the over-the-air capacity available for user traffic but would exclude all overhead data. Based on this, Comsearch recommends the addition of the following definition of "payload capacity" to Section 101.3:

> *Payload Capacity*. The bit rate available for transmission of data over a radiocommunication system, excluding overhead data generated by the system.

Moreover, the FCC Form 601 form requires clarification to the extent that it requires entry of the "baseband digital rate in kbps" which the Commission presumably uses for enforcement of the payload capacity requirements by comparing the entry to the requested emission designator bandwidth. Since this "baseband digital rate" is apparently the same as the "payload capacity" required in Section 101.141(a)(3), the Commission could reduce the potential for confusion by using consistent terminology with a single definition.

Comsearch also recommends a revision to Section 101.141(a)(3) to de-emphasize the legacy of TDM data rates and instead emphasize a consistent efficiency requirement in terms of bits-per-second-per-Hertz ("bps/Hz"). Presently the rule lists "typical utilization" of the required payload capacity for each channel bandwidth in terms of multiples of TDM (DS-1 and DS-3/STS-1) rates. While these examples were typical when the rule was written, they are becoming outmoded with the growth of systems that support other interfaces such as IP. Furthermore the listed typical utilizations are unnecessary to the operation of the rule. Therefore Comsearch recommends deleting the TDM-based references. It also is noteworthy that the listed minimum payload capacity (Mbits/s) rates are multiples of the basic TDM DS-1 (1.54 Mbits/s) and DS-3 (44.7 Mbits/s) rates. The result is varying bandwidth efficiency requirements based on channel bandwidth ranging from 2.46 to 4.47 bps/Hz. With input from radio vendors and other

interested parties, the Commission should migrate these legacy requirements towards more uniform requirements in terms of efficiency (bps/Hz).

C. Streamlining the Application Requirements for Adaptive Modulation

A radio system that uses adaptive modulation shifts through the available profiles [modulation + capacity + bandwidth + transmitter power] in response to conditions such as signal fading or received interference. Presently, the Commission interprets its rules to require that each profile must be licensed individually. Thus each profile becomes a separate row on the Form 601 application and on the license, even though the frequency that is requested and authorized is the same for each row, and the configuration shown on each row is only operated for a fraction of the time. This interpretation appears to rest on the facts that: (1) under Section 1.929(d), changes in emission type, increases in bandwidth, and increases in EIRP greater than 3 dB are major changes (although some adaptive modulation radios may keep the emission, bandwidth, and EIRP constant through profile shifts) and (2) the "Baseband Digital Rate (kbps)" and "Digital Modulation Type" are items requested on the Form 601 application form and would be different for each profile.

To simplify the process of licensing systems with adaptive modulation, Comsearch recommends that the Commission allow filing for adaptive modulation frequencies as a single row. As long as the same emission designator applies to each profile, the applicant should be able to enter the frequency once on the application and indicate use of adaptive modulation with a Yes/No checkbox similar to ATPC. The applicant would then enter a range or table of EIRP + Baseband Digital Rate (kbps) + Digital Modulation Type combinations for the profiles that would be used. This procedure should not have any negative impact on interference protection because interference calculations from adaptive modulation systems would use the proper coordinated transmitter power and EIRP, and the interference objectives for calculations into

adaptive modulation systems should be based on the receiver noise floor and thus consistent across modulation profiles.

D. Low Power Limited Coverage Systems

The FCC rules contain a provision for 23 GHz "low power limited coverage systems" in Section 101.147(s)(8). This provision allows for the use of sub-standard antennas on frequencies in the ranges 21.8-22.1 GHz and 23.0-23.3 GHz. Frequencies in these ranges have become the most important and most used in 23 GHz because they are available for conditional authorization under Section 101.31(b). Thus, it is especially important to avoid inefficiency on these frequencies; indeed, antennas of one foot diameter that meet Standard A are readily available. The low power limited coverage provision was used in the past for low cost analog video systems for purposes such as surveillance. Such systems are now outmoded, and Comsearch is not aware of any current usage. The Commission should delete Section 101.147(s)(8) from its rules as unnecessary.

VI. COMSEARCH SUPPORTS PROMPT ACTION ON THE PENDING PETITIONS FOR RULEMAKING FILED BY THE FWCC

Comsearch supports favorable action on two pending petitions for rulemaking filed by the Fixed Wireless Communications Coalition ("FWCC"). First, in RM-11605, the FWCC requests the Commission to amend its rules to allow non-Federal fixed microwave systems to share the Federal 7125 – 8500 MHz band to meet the looming need for backhaul spectrum for wireless networks. Comsearch agrees that the fixed microwave services proposed by FWCC to share the 7125-8500 MHz band are compatible with the existing government uses of the band and that sharing is possible on a co-primary basis using a first-come first-served frequency coordination approach. The Commission, therefore, should in conjunction with NTIA promptly commence a rulemaking proceeding on the feasibility of sharing the band. The rulemaking also

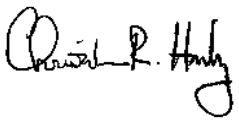
should address Federal/non-Federal frequency coordination, specifically the exchange of usage requests and responses, with the goal of streamlining and automating the process.

Second, in Petition RM-11610, FWCC seeks to improve Federal/Non-Federal coordination in the 23 GHz band and to allow conditional authorization based on prior coordination across the entire band. Comsearch supports the petition and agrees with FWCC that implementation of a process similar to that used in the 70/80/90 GHz bands to facilitate sharing can be used to accommodate the 23 GHz band.

VII. CONCLUSION

For the foregoing reasons, Comsearch encourages the Commission to take action in this proceeding consistent with the recommendations set out above.

Respectfully submitted,



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